CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer:

1. In which of the following cities, photochemical smog formed is minimum?

(1) Kashmir (2) New Delhi

(3) Hyderabad (4) Kolkata

Answer (1)

Sol. Cold place will have minimum photochemical smog.

2. Number of P – O – P bonds in H_3PO_4, P_4O_{10} and $(HPO_3)_3$ are (respectively)

(1) 0, 6, 3 (2) 6, 3, 0

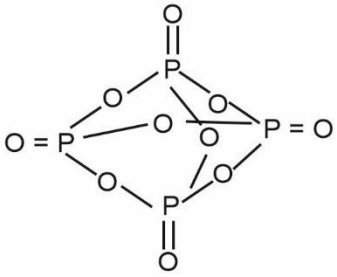
(3) 1, 4, 3 (4) 0, 5, 4

Answer (1)

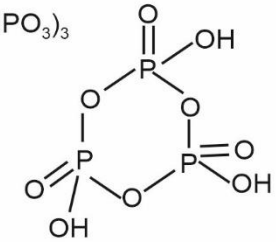
Sol. H_2PO_4

P – O – P bonds = 0

P_4O_{10} (P– O – P bonds = 6)



$(HPO_3)_3$



(3 P– O – P bonds)

3. **S-1:** According to Bohr's model, angular momentum is quantised for stationary orbits.

S-2: Bohr's Model doesn't follow Heisenberg's uncertainty principle.

(1) Both S-1 and S-2 are true

(2) S-1 is true and S-2 is false

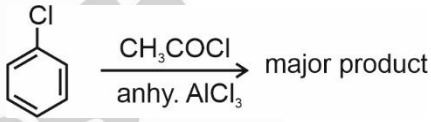
(3) S-1 is false and S-2 is true

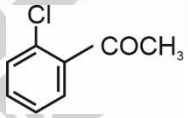
(4) Both S-1 and S-2 are false

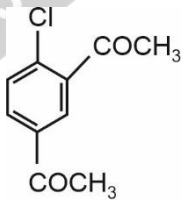
Answer (1)

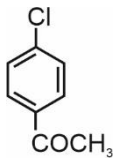
Sol. Both statements are true.

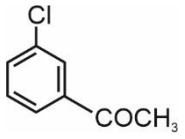
4. Consider the reaction :



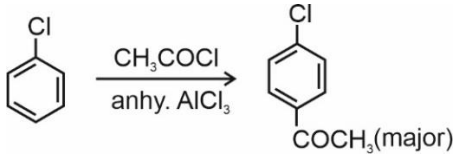
(1) 

(2) 

(3) 

(4) 

Answer (3)

Sol. 

5. Calculate ratio of radii of 2nd & 3rd Bohr's orbit of H-atom.

(1) 2 : 3

(2) 3 : 2

(3) 4 : 9

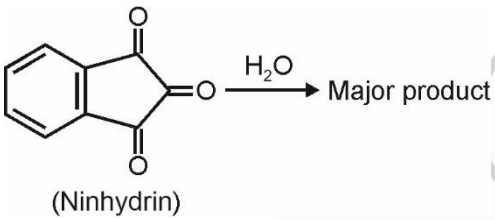
(4) 9 : 4

Answer (3)

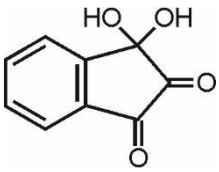
Sol. $r \propto n^2$

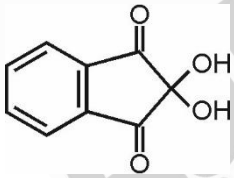
$$\frac{r_2}{r_3} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$$

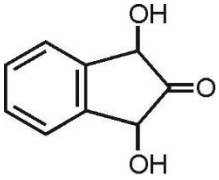
6. The major product formed in the following reaction is

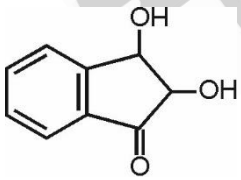


(Ninhydrin)

(1) 

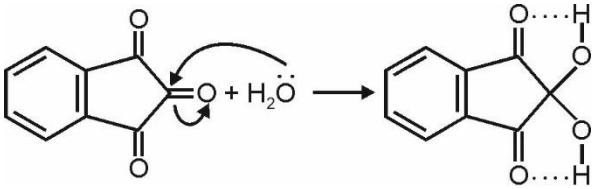
(2) 

(3) 

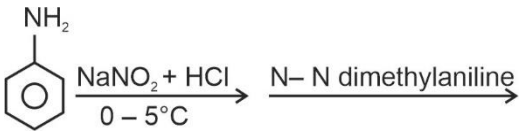
(4) 

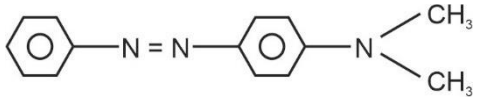
Answer (2)

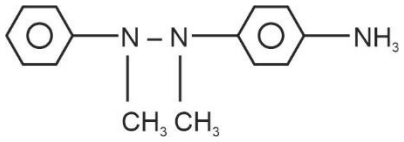
Sol. Ninhydrin has three carbonyl groups. Two of them are in conjugation with benzene ring. So water adds to the carbonyl group which relatively free forming gem diol. The gem diol does not undergo dehydration as it is stabilished by intramolecular H-bond.

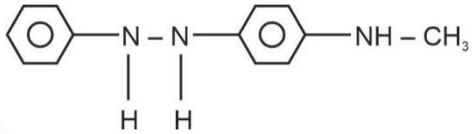


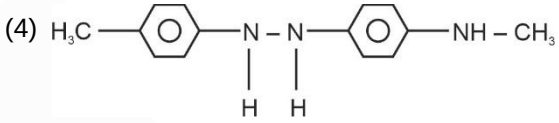
7. The product of the following reaction is:



(1) 

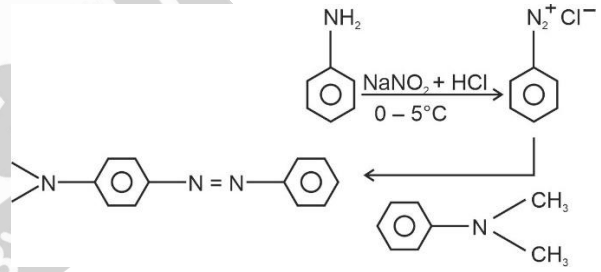
(2) 

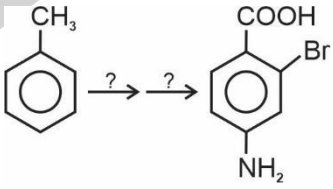
(3) 

(4) 

Answer (1)

Sol.



8. 

(1) (i) HNO_3/H_2SO_4
(ii) $Br_2/AlCl_3$
(iii) $KMnO_4/H^+$

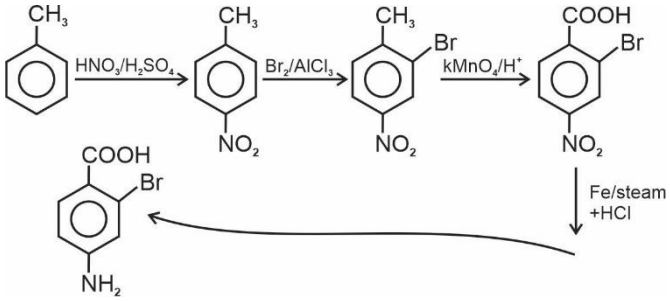
(2) (i) HNO_3/H_2SO_4
(ii) $Br_2/AlCl_3$
(iii) Fe/steam + HCl
(iv) $KMnO_4/H^+$

(3) (i) $Br_2/AlCl_3$
(ii) HNO_3/H_2SO_4
(iii) $KMnO_4/H^+$
(iv) Fe/steam + HCl

(4) (i) HNO_3/H_2SO_4
(ii) $Br_2/AlCl_3$
(iii) $KMnO_4/H^+$
(iv) Fe/steam + HCl

Answer (4)

Sol.



9. Out of the following which has maximum CFSE? (Consider with sign)

(1) $Fe(H_2O)_6]^{3+}$

(2) $[Ti(H_2O)_6]^{3+}$

(3) $[Mn(H_2O)_6]^{3+}$

(4) $[Cr(H_2O)_6]^{3+}$

Answer (1)

Sol. $[Fe(H_2O)_6]^{3+}$ has $t_{2g}^3\ e_g^2$ configuration and has zero value for CFSE.

10. In CsCl crystal, which of the following relations is true?

(1) ${}^rCs^{\oplus} + {}^rCl^{\ominus} = \frac{\sqrt{3}a}{2}$

(2) ${}^rCs^{\oplus} + {}^rCl^{\ominus} = \frac{a}{\sqrt{2}}$

(3) ${}^rCs^{\oplus} + {}^rCl^{\ominus} = \frac{a}{2}$

(4) ${}^rCs^{\oplus} + {}^rCl^{\ominus} = \frac{\sqrt{3}}{\sqrt{2}}\ a$

Answer (1)

Sol. As $Cs^{\oplus}$ occupies cubical voids, we have

$${}^rCs^{\oplus} + {}^rCl^{\ominus} = \frac{\sqrt{3}a}{2}$$

11.

	Column I **Monomer unit**	**Column-II** **Polymer**
(a)	Acrylonitrile	(i) Orlon
(b)	Tetra-Fluoroethene	(ii) Natural Rubber
(c)	Caprolactam	(iii) Teflon
(d)	Isoprene	(iv) Nylon-6

(1) a → (i); b → (ii); c → (iii); d → (iv)

(2) a → (i); b → (iii); c → (iv); d → (ii)

(3) a → (ii); b → (iv); c → (iii); d → (i)

(4) a → (iii); b → (ii); c → (iv); d → (i)

Answer (2)

Sol.

Monomer unit		**Polymer**
Acrylonitrile	—	Orlon
Tetra-Fluoroethene	—	Teflon
Caprolactam	—	Nylon-6
Isoprene	—	Natural Rubber

12. In which of the following is not an example of calcination?

(1) $PbS + O_2 \rightarrow PbO + SO_2$

(2) $CaCO_3 \rightarrow CaO + CO_2$

(3) $MgCO_3 \xrightarrow{\Delta} MgO + CO_2$

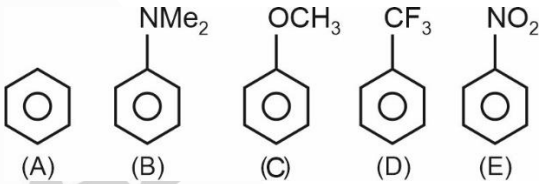
(4) $ZnCO_3 \rightarrow ZnO + CO_2$

Answer (1)

Sol. $PbS + O_2 \rightarrow PbO + SO_2$

is an example of roasting.

13. Rate of electrophilic aromatic substitution.



(1) B > C > A > D > E (2) A > B > C > D > E

(3) E > D > C > B > A (4) A > B > D > C > E

Answer (1)

Sol. B > C > A > D > E

Rate of electrophilic aromatic substitution ∝-electron density in benzene ring.

14. Identify the stationary phase (S) and mobile phase (M) in paper chromatography.

(1) S : Solvent
M : Chromatography paper

(2) S : Solvent
M : Water

(3) S : Water
M : Solvent

(4) S : Chromatography paper
M : Solvent

Answer (4)

Sol. In paper chromatography, a special quality paper called chromatography paper is used.

Chromatography paper contains water trapped in it which acts as a stationary phase. A strip of chromatography paper spotted at the base with the solution of a mixture is suspended in a suitable solvent which acts as a mobile phase.

15. $CH_3CH=CH_2 \xrightarrow[\substack{(2)\ PCC\\(3)\ CH_3MgBr\\(4)\ H_2O}]{\substack{(1)\ BH_3/THF\\H_2O_2/NaOH}} Product$

The product is

(1) $CH_3CH_2-\underset{\displaystyle OH}{\underset{|}{C}}H-CH_3$

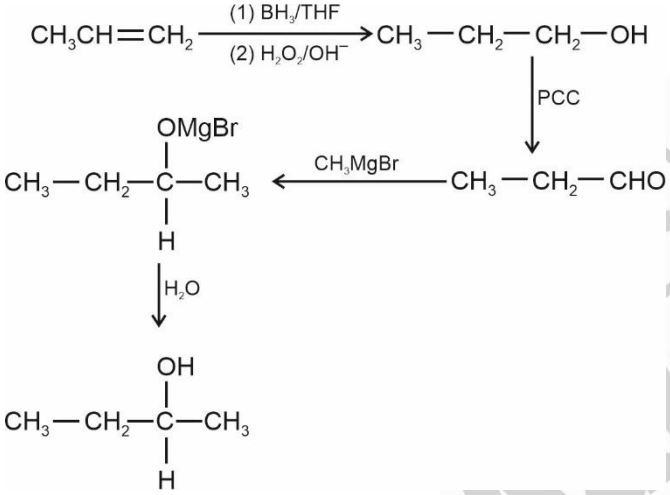
(2) CH_3CH_2COOH

(3) $CH_3CH_2-\underset{\displaystyle OH}{\underset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}H-CH_3$

(4) CH_3-CH_2CHO

Answer (1)

Sol.



16. The ratio of silica to alumina in cement is

(1) 5.5

(2) 2

(3) 3

(4) 1.5

Answer (3)

Sol. For good quality cement, the ratio of silica (SiO_2) to alumina (Al_2O_3) should be between 2.5 and 4.

17. **Statement I :** pH of 10^{-8} M HCl is 8 at 25°C

Statement II : Titration of weak acid & strong base at Half equivalence point gives pH = $\frac{pKa}{2}$.

(1) Statement I is correct and Statement II is correct

(2) Statement I and II both are incorrect

(3) Statement I is incorrect and Statement II incorrect

(4) Statement I is correct and Statement II is incorrect

Answer (2)

Sol. 10^{-8} M HCl is acidic solution hence pH will be less than 7 at 25°C and incomplete titration of weak acid by strong base upto half equivalence point results in buffer with pH = pKa of weak acid.

18. **Assertion A :** $MgCl_2$ and $BeCl_2$ gives flame test

Reason R : Ionization energy of Be and Mg is high

(1) A is incorrect but R is correct

(2) A is incorrect and R is also incorrect

(3) A is correct, R is correct and R is correct explanation of A

(4) A is correct, R is correct, R is not the correct explanation of A

Answer (1)

Sol. $MgCl_2$ and $BeCl_2$ do not give flame test as both have high ionization energy.

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g., 06.25, 07.00, –00.33, –00.30, 30.27, –27.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.

21. How many of the following statements are correct.

(1) Conductivity (K) decreases with increase in dilution for both strong & weak electrolyte

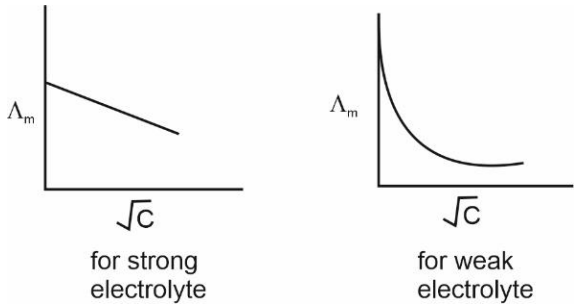
(2) Molar conductivity increases with increase in dilution for both strong and weak electrolyte

(3) Molar conductivity increases with increase in 'α' for weak electrolyte.

(4) Change in molar conductivity is same for both strong and weak electrolyte with increase in dilution.

Answer (3)

Sol. Except (4) all statements are correct.



for strong electrolyte

for weak electrolyte

22. Lowering of vapour pressure of 30% of aqueous solution of glucose. (in mm Hg)

$P_{H_2O} = 760$ mm of Hg

Answer (729.00)

Sol. $\frac{760 - x}{x} = \frac{\left(\frac{30}{180}\right)}{\left(\frac{70}{18}\right)} = \frac{3}{70}$

x = 728.7 mm Hg

≈ 729 mm Hg

23. What is the change in oxidation state of Mn in the reaction

$KMnO_4 + KI \xrightarrow{\text{acidic medium}}$

Answer (5)

Sol. $KMnO_4 + KI \xrightarrow{H^{\oplus}} I_2 + Mn^{2+}$

Change in oxidation state of Mn = 5

24. How many of the following have 10 electrons?

(i) O^{2-} (ii) O

(iii) Al^{3+} (iv) Al

(v) F (vi) F^-

(vii) Mg^{2+} (viii) Mg

(ix) N^{3-}

Answer (05)

Sol.

Species	Number of electrons
O^{2-}	10
O	8
Al^{3+}	10
Al	13
F	9
F^-	10
Mg^{2+}	10
Mg	12
N^{3-}	10

25. Oxidation state of Cr in chromyl chloride is

Answer (6)

Sol. : In CrO_2Cl_2; oxidation state of Cr is +6

26. For a radioactive decay $t_{1/2} = 15$ years . What will be the rate constant (yr^{-1})?

Answer (0.05)

Sol. $k = \frac{0.613}{t_{1/2}}$

$= 0.0462\ yr^{-1} \simeq 0.05\ yr^{-1}$

27.

28.

29.

30.